

CLAIMS

What is claimed is:

1. A method of initializing an ITU Recommendation G.729 Annex B voice activity detection (VAD) device, comprising the steps of:

extracting a set of parameters from a signal that characterize said signal;
calculating an energy measure of said signal from said set of parameters;
comparing said energy measure with a reference value;
determining an initial value for an average of a noise characteristic of said signal;

and

counting the number of times said energy measure equals or exceeds said reference level.

2. The method according to claim 1, further comprising the step of:
performing the sequential process of steps recited in claim 1 repeatedly, in their listed order, until said number of times equals thirty-two.

3. A method of initializing an ITU Recommendation G.729 Annex B voice activity detection (VAD) device, comprising the steps of:

extracting a set of parameters characterizing a signal from a digital representation of said signal within a data frame, wherein said parameters are the autocorrelation coefficients, which are derived in accordance with said Recommendation G.729, and are denoted by $\{R(i)\}_{i=0}^q$;

calculating a full-band frame energy by multiplying a value of ten times a base ten logarithm of a quotient obtained by dividing a first autocorrelation coefficient $R(0)$, of said autocorrelation coefficients, by a constant value of 240;

comparing said full-band frame energy with a reference level;

updating initial values for averages of the noise characteristics in accordance with said Recommendation G.729 Annex B; and

13 changing the value of a frame counter during said initialization only if said full-
14 band frame energy equals or exceeds said reference level.

1 4. The method according to claim 3, further comprising the step of:
2 performing the sequential process of steps recited in claim 3 repeatedly, in their
3 listed order, until said frame count has been changed thirty-two times.

1 5. A method of converging an ITU Recommendation G.729 Annex B voice activity
2 detection (VAD) device, comprising the steps of:

3 determining a noise identification threshold value;
4 comparing a number of energy measures of a signal to said noise threshold value;
5 determining a first value representing an average of said number of energy
6 measures, when said energy measure is less than said noise threshold, wherein only the
7 energy measures of said number of energy measures having values less than said noise
8 threshold value are used to determine said first value;

9 determining a second value representing an average of said number of energy
10 measures; and

11 substituting said first value for said second value when a specific event occurs.

1 6. The method according to claim 5, wherein:

2 said specific event is an increasing divergence between said first and second
3 values with time.

1 7. The method according to claim 5, wherein:

2 said specific event is the expiration of a period of time.

1 8. The method according to claim 5, further comprising the step of:

2 counting the number of consecutive times said energy measures of said number of
3 energy measures equal or exceed a reference value, wherein

only the energy measures of said number of energy measures having values less than said reference value are used to determine said second value, and said specific event is a predetermined number of consecutive times said energy measures of said number of energy measures equal or exceed said reference value.

9. A method of converging an ITU Recommendation G.729 Annex B voice activity detection (VAD) device, comprising the steps of:

- determining a noise identification threshold value;
- comparing a number of energy measures of a signal to said noise threshold value;
- determining a differential spectral distance, ΔSD , between a current spectral state of said signal and a value representing an average of a number of prior spectral states of said signal;
- updating a first set of values representing averages of said signal's noise characteristics, when said energy measure is less than said noise threshold;
- updating a second set of values representing averages of said signal's noise characteristics, when said energy measure is less than a reference value and said differential spectral distance has a value less than about 0.0637; and
- substituting said first value for said second value when a specific event occurs.

10. The method according to claim 9, further comprising the step of:

- counting the number of consecutive times said energy measures of said number of energy measures equal or exceed said reference value, wherein
- said specific event is a predetermined number of consecutive times said energy measures of said number of energy measures equal or exceed said reference value.

11. The method according to claim 5, further comprising the steps of:

- determining the lesser of two values T_1 and T_2 ,
- multiplying said lesser value of T_1 and T_2 by two to obtain a product;
- comparing said product to a value of -21 dBm;

5 assigning the lesser value of -21 dBm and said product to said noise threshold
6 value for an updating period, τ_p .

1 12. The method according to claim 9, further comprising the steps of:
2 determining the lesser of two values T_1 and T_2 ,
3 multiplying said lesser value of T_1 and T_2 by two to obtain a product;
4 comparing said product to a value of -21 dBm;
5 assigning the lesser value of -21 dBm and said product to said noise threshold
6 value for an updating period, τ_p .

1 13. The method according to claim 11, further comprising the steps of:
2 measuring the maximum block energy occurring during said updating period, τ_p ,
3 and assigning said measured maximum block energy to E_{\max} ;
4 measuring the minimum block energy occurring during said updating period, τ_p ,
5 and assigning said measured maximum block energy to E_{\min} ;
6 calculating said value of T_1 given by the equation $T_1 = E_{\min} + (E_{\max} - E_{\min})/32$; and
7 calculating said value of T_2 given by the equation $T_2 = 4 * E_{\min}$.

1 14. The method according to claim 12, further comprising the steps of:
2 measuring the maximum block energy occurring during said updating period, τ_p ,
3 and assigning said measured maximum block energy to E_{\max} ;
4 measuring the minimum block energy occurring during said updating period, τ_p ,
5 and assigning said measured maximum block energy to E_{\min} ;
6 calculating said value of T_1 given by the equation $T_1 = E_{\min} + (E_{\max} - E_{\min})/32$; and
7 calculating said value of T_2 given by the equation $T_2 = 4 * E_{\min}$.

1 15. A method of converging an ITU Recommendation G.729 Annex B voice activity
2 detection (VAD) device, comprising the steps of:

3 measuring the maximum block energy occurring during an updating period, τ_p , and
 4 assigning said measured maximum block energy to E_{\max} ;
 5 measuring the minimum block energy occurring during said updating period, τ_p ,
 6 and assigning said measured minimum block energy to E_{\min} ;
 7 calculating a value of T_1 given by the equation $T_1 = E_{\min} + (E_{\max} - E_{\min})/32$;
 8 calculating a value of T_2 given by the equation $T_2 = 4 * E_{\min}$;
 9 determining the lesser value of said values T_1 and T_2 ,
 10 multiplying said lesser value of T_1 and T_2 by two to obtain a product;
 11 comparing said product to a value of -21 dBm;
 12 assigning the lesser value of -21 dBm and said product to a noise threshold value;
 13 comparing a number of energy measures of a signal to said noise threshold value;
 14 determining a differential spectral distance, ΔSD , between a current spectral state
 15 of said signal and a value representing an average of a number of prior spectral states of
 16 said signal;
 17 updating a first set of values representing averages of said signal's noise
 18 characteristics, when said energy measure is less than said noise threshold;
 19 updating a second set of values representing averages of said signal's noise
 20 characteristics, when said energy measure is less than a reference value and said
 21 differential spectral distance has a value less than about 0.0637;
 22 counting the number of consecutive times said energy measures of said number of
 23 energy measures equal or exceed said reference value; and
 24 substituting said first value for said second value when said number of consecutive
 25 times exceeds a predetermined value.

1 14. The method according to claim 12, further comprising the step of:
 2 updating said noise threshold value about every 1.28 seconds during a
 3 communication link.